

ABSTRACT OF THE DISCLOSURE

Conversion coatings based on cobalt are described for substrate metals such as aluminum, zinc, magnesium, titanium, cadmium, silver, copper, tin, lead, cobalt, zirconium, beryllium, or indium, their alloys, or items coated with these metals. The conversion coating contains a trivalent or tetravalent cobalt/valence stabilizer complex. The coating bath may also contain a preparative agent or solubility control agent. The oxidized cobalt is present in the coating in a “sparingly soluble” form. The valence stabilizers can be either inorganic or organic in nature. Cobalt/valence stabilizer combinations are chosen based on the well-founded principles of cobalt coordination chemistry. A number of cobalt/valence stabilizer combinations that match the performance of conventional hexavalent chromium systems are presented.